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(54) Title of the Invention: Polishing Pad and Manufacturing Method Therefor

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Specification

1. Title of the Invention

Polishing Pad and Manufacturing Method Therefor

2. Claims

1 A polishing pad, wherein a porous synthetic resin with a plurality of air pockets is applied to and integrated with a base sheet, and wherein the air pockets are formed by dissolving and removing short fibers implanted in the synthetic resin.

2 A manufacturing method for a polishing pad, wherein a plurality of short fibers with a prescribed thickness and length are implanted in a base sheet, a synthetic resin is applied to the surface of the base sheet in which the short fibers have been implanted, and the short fibers are dissolved and removed to form air pockets in the synthetic resin.

3. Detailed Description of the Invention

(Industrial Field of Application)

The present invention relates to a polishing pad and a manufacturing method for the polishing pad used in the polishing of a variety of materials such as metal, plastic, glass and ceramics.

(Prior Art)

Polishing pads used to polish the materials mentioned above are usually made of suede cloth, especially the pads used to give these materials a final polishing. This is because suede cloth is supple and its surface easily retains polish.

In recent years, however, there has been growing demand for more refined surfaces with mirror-like finishes. In order to meet this demand, various high-performance polishing pads have been developed to replace suede cloth.

For example, the polishing pad in FIG 12 (A) and (B) is a base sheet 1 which has been coated with a urethane resin 2 having a plurality of air pockets 3. However, because of configurational problems resulting from the manufacturing method, the demanded polishing precision of this pad is limited.

After the base sheet 1 of this polishing pad has been coated with a foamy urethane resin 2, the urethane resin 2 is immersed in water and allowed to foam. Once dry, the surface of the urethane foam 2 is shaped through grinding. However, because the air pockets 3 are formed by allowing the urethane resin 2 to foam, it is nearly impossible to create air pockets whose size, shape and depth are constant and whose distribution is uniform. In fact, there is considerable variation.

For this reason, the polishing pad cannot retain the particles of a fine polish uniformly throughout, and there is variation in the polishing rate and polishing life. As a consequence, uniform high-precision polishing is impossible and scratching is more likely to occur. It is therefore more difficult to automate the polishing process. As shown in FIG 12 (A), (B) and FIG 13 (A), (B), the abrasiveness of the pad surfaces is irregular. This readily leads to variations in polishing conditions.

(Problem Solved by the Invention)

The problem of the present invention is to provide a polishing pad in which the size, shape and depth of the air pockets are constant and in which their distribution is uniform.

(Means of Solving the Problem)

In order to solve this problem, the present invention is a polishing pad, wherein a porous synthetic resin with a plurality of air pockets is applied to and integrated with a base sheet, and wherein the air pockets are formed by dissolving and removing short fibers implanted in the synthetic resin.

The present invention is also a manufacturing method for a polishing pad, wherein a plurality of short fibers with a prescribed thickness and length are implanted in a base sheet, a synthetic resin is applied to the surface of the base sheet in which the short

fibers have been implanted, and the short fibers are dissolved and removed to form air pockets in the synthetic resin.

(Working Examples)

The following is a more detailed explanation of the present invention with reference to the drawings.

In the manufacture of the polishing pad of the present invention, first, as shown in FIG 1, the base sheet 10 is prepared from a material such as an unwoven cloth of polyester fibers. A plurality of short fibers 11 of predetermined shape and dimensions are then implanted standing up on one side of the base sheet 10 using, for example, the electrostatic hair method.

The short fibers 11 have to be soluble in an acid, alkali, water or a solvent such as an organic solvent. They can be made, for example, of a metal such as aluminum, a plastic such as polyvinyl alcohol (PVA), or a ceramic.

The shape and dimensions of the short fibers 11 can be selected based on such factors as the material to be polished, the type of polish to be used, and the purpose of the polishing process. For example, as shown in FIG 7 (A) through (G), the short fibers can be column-shaped, square column-shaped, cone-shaped, spindle-shaped, square spindle-shaped, or droplet-shaped. The maximum thickness can range from several to several hundred micrometers, and the length can range from several micrometers to several millimeters. When forming a pad to polish semiconductor wafers, the short fibers

used should have a thickness ranging between 30 and 50 μm, and a length ranging between 500 and 600 μm.

In the example shown in the figures, column-shaped short fibers 11 are used.

When these short fibers 11 are implanted using the electrostatic hair method, the device shown in FIG 6 can be used. Because the upper electrode 22 has a vacuum checking means connected to the vacuum pump 21 and the lower electrode 23 can move up and down with an expanding and contracting arm 24 inside the acrylic chamber 20, the base sheet 10 with an adhesive agent 25 applied is suctioned and held by the upper electrode 22 while the short fibers 11 to be implanted are placed on top of the lower electrode 23. When a high negative direct current voltage is applied to the lower electrode 23 while the upper electrode 22 remains grounded, the statically charged short fibers 11 are adsorbed so as to stand up on the base sheet 10 at a fairly constant interval, as shown in FIG 2, and become attached integrally to the adhesive agent 25.

Next, as shown in FIG 3, a urethane resin 12 is applied to a certain thickness (e.g., 500 μm) allowing the ends of the short fibers 11 to remain exposed on the side of the base sheet 10 on which the short fibers 11 were implanted. After allowing the resin to dry, the short fibers 11 are dissolved and eliminated using an acid, alkali, water, or solvent such as an organic solvent. The result, as shown in FIG 4 and FIG 5, is a polishing pad with a plurality of air pockets 13 formed by the removal of the short fibers 11.

When the short fibers 11 are to be removed using a solvent, the solvent should be selected based on the material of the short fibers 11. For example, an acid should be used if the short fibers are made of aluminum, and water should be used if the short fibers are made of polyvinyl alcohol.

If the short fibers have a shape other than column-shaped, the air pockets formed will have a corresponding shape.

Because the size, shape, depth and distribution of the air pockets 13 formed by the removal of the short fibers 11 are all fairly constant, polishing pads formed in this manner have a fairly constant polishing rate and polishing life throughout. Also, because there is no variation in the abrasiveness of the pad surface, extremely high-precision polishing can be performed.

Furthermore, when short fibers 11 are implanted on a base sheet 10 in this manner, as shown in FIG 8, the short fibers 11 can be implanted at an angle. Consequently, as shown in FIG 9, the polishing pad can be furnished with air pockets 13 disposed at an angle. By controlling the angle and orientation of the short fibers, air pockets can be formed peripherally, the orientation of the air pockets can be changed for different sections of the pad, or the air pockets can be oriented randomly. In other words, different types of polishing pads can be obtained for different uses.

In order to implant the short fibers at an angle, the short fibers attached to the base sheet can be moved physically or, as shown in FIG 10, a magnet 26 can be used to apply a magnetic field to magnetic short fibers 11.

When implanting short fibers on a base sheet 10, an adhesive agent 25 can be applied in a particular pattern using the screen-printing method, and the short fibers 11 can be implanted on the pattern. For example, as shown in FIG 11 (A) through (D), a polishing pad can be formed in which the air pockets 13 are formed in particular patterned regions 27.

(Effect of the Invention)

Because, as explained above, by implanting a plurality of short fibers in a synthetic resin and then dissolving and removing the short fibers to create air pockets, the present invention is able to provide a polishing pad in which the size, shape and depth of the air pockets are constant and in which their distribution is uniform throughout the pad. In this way, a polishing pad can be easily formed in which the polishing rate and polishing life are constant throughout.

These polishing pads can be used to perform high-precision polishing without scratches.

4. Brief Explanation of the Drawings

FIG 1 through FIG 4 are partial cross-sectional views of the stages in the manufacturing method for the polishing pad of the present invention. FIG 5 is a frontal view of the polishing pad of the present invention in FIG 4. FIG 6 is a simplified configurational view of a device using electrostatic hairs. FIG 7 (A) ~ (G) are perspective views of short

fibers. FIG 8 is a partial cross-sectional view of a case where the short fibers are implanted at an angle. FIG 9 is a partial cross-sectional view of the polishing pad obtained thereby. FIG 10 is a cross-sectional view of one method used to implant the short fibers at an angle. FIG 11 (A) ~ (D) are diagrams used to explain air pocket forming patterns. FIG 12 (A) and (B) are a partial cross-sectional view and frontal view, respectively, of a polishing pad of the prior art. FIG 13 (A) and (B) are a partial cross-sectional view and frontal view, respectively, of the abrasiveness thereof.

10 ... Base Sheet

11 ... Short Fibers

12 ... Synthetic Resin

13 ... Air Pocket

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FIG 1

Voltage

FIG 2

FIG 3

FIG 4

FIG 5

FIG 6

FIG 7

FIG 8

FIG 9

FIG 10

FIG 11

FIG 12

FIG 13